Professor under the new statutes. He was made an Honorary Fellow of St. John's College, Cambridge, in 1886.

He was twice married: first in 1834 to Emily, daughter of J. Newton, Esq.; secondly in 1858 to Rosalind, daughter of Alexander Campbell, Esq., of Tunbridge Wells. His second wife died about a year before him. He died on Sunday, 1893 May 28, in the eighty-sixth year of his age. H. H. T.

WESLEY STOKER BARKER WOOLHOUSE was born at North Shields on 1809 May 6. His father was a greengrocer in North Shields, and in the boy's earlier years he carried the wares to the customers. At an early age, however, he showed a great facility in solving mathematical problems, and was often stopped on his way with his basket by an old mathematician who delighted in testing his powers. He went to Leitch's school, a famous academy in North Shields, and doubtless owed much to the excellent teaching he there received. But his love of science was hereditary, for his father was a keen amateur astronomer, and, it is said, injured his sight by his devotion to observing; indeed, during his latter years he became quite blind, and his son would lead him by the arm for a walk in the fields. There is evidence extant of the interest taken in the clever boy by his teachers in the shape of three testimonials dated 1821 July, and signed by George Sharp, the head-master, and John Charlton and Robert Marshall "mathematicians;" the first of which commences: "This book contains 395 problems in Mensuration and Algebra, solved and written down in my school in thirty-six days, by Wesley Woolhouse, a boy aged twelve"—thirty-three of the problems being in quadratic equations—and concludes, "I have no hesitation in stating it as my opinion that, should he have the fortune to be taken under the patronage of the learned, his genius in mathematics will amply compensate their attention." He obtained the prize in the *Ladies' Diary* at thirteen years of age. Nothing of particular interest, however, is recorded about his next few years, until at nineteen he published a little work on "Geometry of Two Dimensions," and wrote a paper on "Analytical Dynamics," in both cases depending upon his own invention or rediscovery rather than on his reading of existing works, to which, apparently, he had not had access. About the same period many eminent mathematicians were contributors to the mathematical department of the *Newcastle Magazine*, and here Woolhouse gained several triumphs, as in the case of his own problem of a heavy bar falling over a pulley, to which he received only one solution. He thus became known as a mathematician throughout England, and when the *Nautical Almanac* Office was reconstructed in 1830, he was made deputy superintendent. The Almanac had previously been prepared under the Astronomer Royal's direction, and the contents had remained generally unchanged for many years. But a Committee appointed by the Royal Astronomical Society drew up an entirely new plan for the

work, which was adopted in the volume for 1834, under the superintendence of Lieutenant Stratford. The first edition of this volume, consisting of 7,000 copies, was published on 1833 July 19, and was entirely out of print on 1834 April 11, necessitating the preparation of a second edition. Mr. Woolhouse is mentioned in the volume as having had a large share in the final checking of the computations; but in the volume for 1835 he also wrote a valuable appendix, giving "Tables for Computing the Phenomena of Jupiter's Satellites;" and a smaller one on the "Computation of the Ephemeris of a Comet from its Elements." These were the first members of what proved to be a brilliant series, being followed by an admirably complete memoir on "Eclipses" in the volume for 1836 (occupying nearly 100 pages), and a fourth in the volume for 1837, on the "Determination of the Longitude from an Observed Solar Eclipse or Occultation" (which is preceded by Airy's paper on "Perturbations"). There is no doubt that he also wrote the memoir on "Halley's Comet" in the volume for 1839; but a difficulty arose between him and the superintendent, which led to his leaving the *Nautical Almanac* Office and becoming actuary to the International Loan Fund. It is not necessary here to enter into the merits of the dispute; but it is recorded of Woolhouse that such work as he did on Halley's Comet so exhausted him that he afterwards slept for thirty-six hours at a stretch.

About this period he gave in White's *Ephemeris* a new method of finding the latitude and longitude, which the late Mr. Edward Riddle characterised as one of the greatest improvements in nautical astronomy of the century.

His first important work relating to life assurance was in 1839, when he published his well-known "Investigation of the Mortality in the Indian Army;" and about 1844 he graduated the "17 offices" mortality table. But between that date and 1861, he does not appear to have written anything relating to a subject with which his name must ever be inseparably associated. But in 1861 he commenced a series of valuable papers in the *Journal of the Institute of Actuaries*, and for years scarcely a volume was issued without containing something from Mr. Woolhouse. Among the most important of these papers are those on "Interpolation, Summation, and the Adjustment of Mortality Tables;" on "The Construction of Mortality Tables;" and in an epoch-making paper in vol. xv. he gave an "Improved Theory of Annuities and Assurances," introducing in a consistent scheme the methods of the differential calculus into life contingency calculations. His last appearance at the Institute was in 1889, when he read a paper on an "Easy Method of getting out a Rough Estimate Valuation of a Whole-life Assurance Business."

A valuable piece of work, though not of an astronomical character, may perhaps be mentioned. When the discussions arising out of the Ten Hours' Bill were going on, the following question arose: How far the factory girls had to run in a day

when attending the "mules" and trotting backward and forward to tie the threads which were constantly breaking? The problem was one in probabilities, and Mr. Woolhouse's aid was asked by Lord Ashley. He went down to Manchester to obtain his data, and solved the problem, showing that the thread-tying girls ran upwards of thirty miles a day.

In 1858 a public dinner was given to Mr. Woolhouse by his fellow-townsmen of North Shields; and Mr. Dodd, the head-master of his old school, pronounced a eulogium upon him "as a man and a mathematician."

Mr. Woolhouse was an accomplished musician and editor of classical music. Only a few days before his death his name appeared in the *Times* as the arranger of a new issue of works by Hummel, and he was the author of a work on "Musical Intervals, containing an investigation of the temperament of the musical scale, and of the beats of imperfect concords." He also wrote a valuable work on the "Measures, Weights, and Coins of all Nations, and on the Measure of Time," and several mathematical text-books of great excellence.

Those who knew him unite in testifying to the charm of his character—simple and genial to a degree. Towards the close of his life he was very fond of needlework, which he reduced to an exact science, having formulæ for the constituent parts of the articles he made—even for the exact length of cotton to be used in each operation. His friends love to recall a verbal quip in which he used to delight—"What sum of money is the double of itself? One and tenpence, because it is two and twentypence." He lived to the age of $84\frac{1}{2}$, and died in 1893 August.

He was elected a Fellow on 1836 May 13, but contributed no papers to the Society. H. H. T.

Dr. Rudolf Wolf, the Director of the Observatory at Zurich, died on 1893 December 6, at the age of 77, after a few days' illness. Dr. Wolf was born 1816 July 7, at Fällanden, near Zurich, and first studied astronomy in the Zurich High Schools, and later at the Universities of Vienna and Berlin. He did not devote himself entirely to the pursuit of astronomy until 1847, when he was appointed Director of the Observatory at Berne. In this small observatory he began the researches on Sun-spot phenomena, with which his name will be most intimately associated in future years. These observations he continuously carried on until his death, and his most important conclusions may be briefly summarised. On 1852 July 31, he showed the intimate connection between the periods of Sun-spot activity and of Earth-magnetism. These results were published simultaneously with, but independently of, those of Professor Lamont, of the Munich Observatory, and of Sabine and Gautier. Lamont and Sabine found a period of about 10 or $10\frac{1}{3}$ years. Professor Wolf showed that this period might be more accurately repre-